Climate, Ocean, and Sea Ice Modeling

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The Climate, Ocean and Sea Ice Modeling (COSIM) project develops and maintains advanced numerical models of the ocean and sea ice for use in global climate change projections. Our Parallel Ocean Program (POP) and Community Ice CodE (CICE) are the ocean and sea ice components of the Community Climate System Model and other coupled climate system models. These coupled models are the tools needed for future climate change projections in both national and international climate assessments. In addition to ocean and sea ice models, COSIM scientists are working on a new Community Ice Sheet Model (CISM) to more accurately simulate and predict the fate of large ice sheets covering Greenland and West Antarctica. Ocean ecosystems and their impact on the carbon and sulfur cycles have been another important addition to the physical models.

While the emphasis is on developing ocean and ice models for the climate community, COSIM researchers also use the models to address scientific issues. Our scientific focus is on high-latitude climate changes and their impact on the rest of the globe. This year, much of our focus has been on ice sheets and the interactions between the ocean and ice shelves. Understanding the physical processes behind ice sheet melt is critical for quantifying the rate of melting and the subsequent rise in sea level. We held a workshop at Los Alamos this year to evaluate the most important outstanding issues in ice sheet modeling and to initiate the community-wide development of the CISM model. This workshop was highly successful in unifying and motivating the ice sheet modeling community.

In addition to the ice sheet progress, COSIM scientists released a new version of the CICE model with several physical improvements. We also continued simulations using a very high-resolution configuration of the fully coupled CCSM model with 10-km resolution in the ocean and ice (see Fig. 1). Finally, new efforts have begun in Arctic biogeochemistry and understanding the potential large release of methane from sea-floor methane hydrates. These efforts should lead to exciting new results in the coming year.

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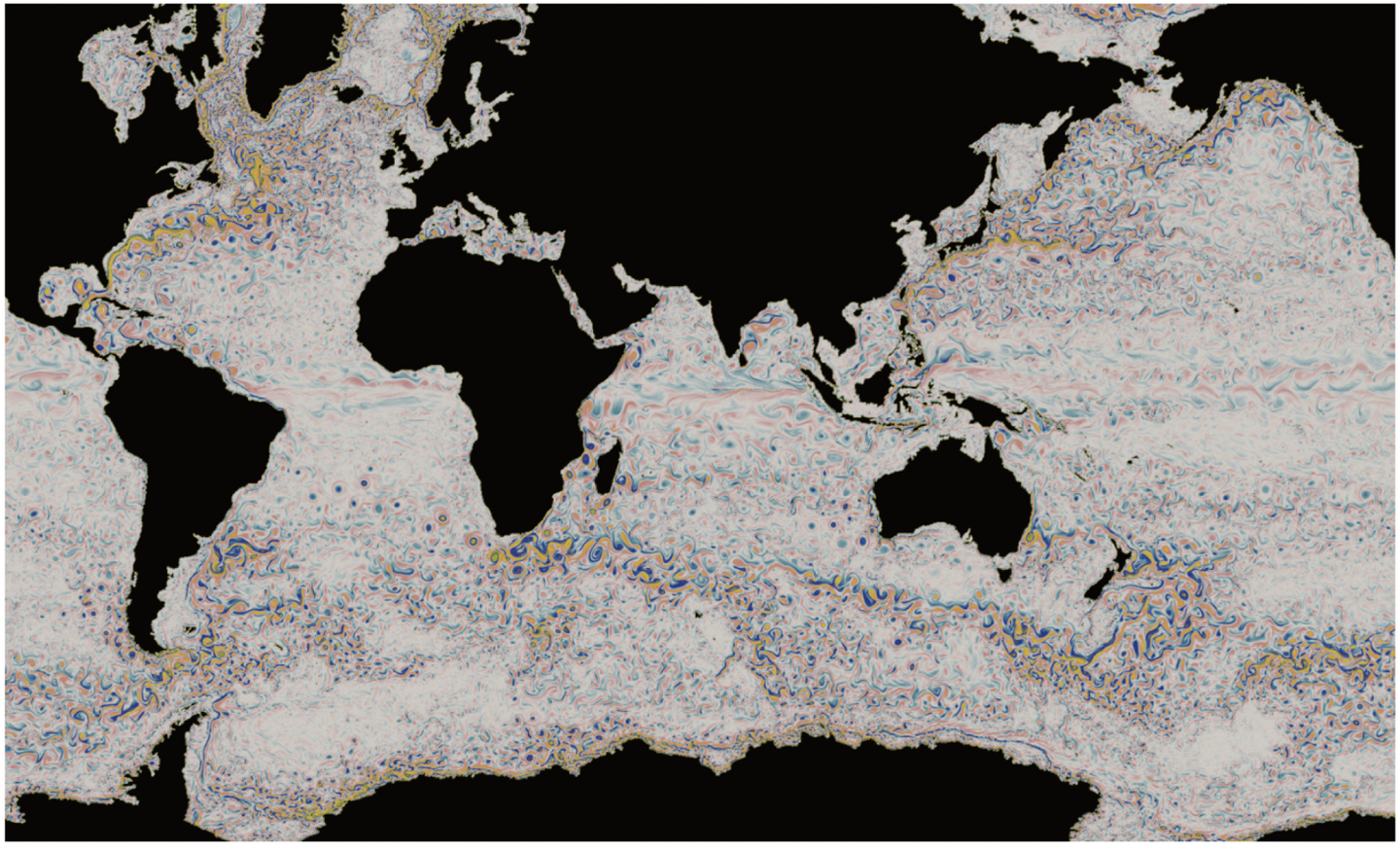

Fig. 1. Relative vorticity (a measure of fluid rotation) at 15m depth from a global eddy-resolving ocean simulation.

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